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Many were the adventures of the Tinkle-Tinkle, and countless the creatures he cheered and helped, yet he never fancied himself any use or knew why he was in the world. He brought home a poor old crab without a claw, and the green bird and the dormice found a hook and screwed it in, and the poor old crab used to carry parcels for the neighbours, but he still lived with the Tinkle-Tinkle.

Another time it was a snail with a broken shell; for him they built a beautiful little house, and he made little rush brooms and sold them to the passers-by, but he lived ever after close to the Tinkle-Tinkle's front door.

So it went on till all the Tinkle-Tinkle's homes were full of strange occupants, and he began to feel very old and worn and weary. Then he remembered the promise of the beautiful Creature and went slowly over the sea hoping the time had come for it to be fulfilled, and it had. The beautiful Creature stretched out its lovely rose and purple wings and wrapped the Tinkle-Tinkle in their warm soft greatness, and bore him down and down through the depths till they came to the Great Gate. At the beautiful Creature's voice it swung slowly back and they passed down the Blue Pathway, which is all ice cut and carved into lovely pinnacles and spires, very blue with the blue of the summer sky and the Southern Sea. The Tinkle-Tinkle could just see it from between the beautiful Creature's wings, stretching away in the blue distance, and at the end one star.

Presently—and though the time had been one thousand years, it had not seemed long to the Tinkle-Tinkle—they came out into a beautiful place that was nothing but light, and the beautiful Creature set the Tinkle-Tinkle down; he looked around him and saw many other Tinkle-Tinkles, and knew them for what they were and loved their beauty, and the Creature gently swept one of its purple pinions across him and the Tinkle-Tinkle took form. He had many many little soft strong hands and many little white feet, and long sweeping wings and a face which shone with something of the light of the beautiful Creature; and the Tinkle-Tinkle saw and understood and sang for joy.

THE SEASONS.

"KNOWLEDGE NEVER LEARNED OF SCHOOLS."

Edited by MISS ARMITT.

THE FLORA OF A GROUSE MOOR.

WHEN the same field is ploughed year after year, the soil within reach of the ploughshare is continually kept loose and open, but the layer of earth below that open soil, deeper than the iron of the plough reaches, is continually hardening under the pressure of the horses, the plough, and the man who ploughs, passing to and fro year after year. In this way is formed artificially what is called a "pan." Natural pans are formed by processes of nature in all thick peat, and in them the water of the surface, of rain or stream, cannot soak below, nor can any water which lies below the pan rise up into it. As a consequence, in wet weather the surface soil of the pan is soaked, in long periods of rainless skies it is parched and dry. No plants can live in such a place that are not able to endure both extremes. Where hill-sides are too steep for layers of peat to lodge, one finds little or no Heather; but on the gentler slopes, where the peat makes the natural pan, there are masses of Heather, Calluna predominating, and the Ericas, *cinerea* and *tetralix*, the Crowberry, associated with it, as well as *Juncus squarrosus*. The leaves of these have all of them much reduced surface, fitting them for the battle of life, "which is in reality a hundred dry seasons in the year." Neither the Bracken of the hill-sides, nor the Blaeberry, are fitted in like manner to cope with these strenuous life conditions. In all parts of the world, Erica and Calluna monopolize these peculiar situations; in south Europe, it is *Erica arborea*—in Africa, on the slopes of Kilimandjero, shrubby Heaths rise higher than a man's head.

The red grouse, which has given its name to our moors, is a species peculiar to our island; the birds live here all the year through, among and beneath the low scrub, which is at once their shelter and their food. They frequent the higher, but not the highest, parts of heather-clad mountains, and in winter they descend to the lower ranges. They feed mainly upon the tender leaves and shoots of Heath and Ling, but also upon Cotton-grass, Willows, Bedstraw and Bilberry: the pieces of Heath which they take are about half an inch long, and they select them as they walk about among the Heather.

Here, in the food of the grouse, we get the main constituents of the flora of a grouse moor. The chief one is undoubtedly Heather or Ling, *Calluna vulgaris*, a much branched, gregarious shrub, often not more than a foot high. It covers many square miles of ground at an altitude of from 500 or 600 feet to 1500 or 1800 feet. In its flowering and its fading time, it paints in gorgeous hues the middle region of the hill slopes. This is due to the fact that its flowers are not deciduous, its sepals are coloured, and they, together with the corolla, remain enveloping the fruit, changing hue merely to a rich rusty brown. Ling is the most widely distributed of all the Heaths, extending over central and northern Europe. On the Continent it seems to have a greater range of altitude than in this island. All plants of it in the lower regions have larger leaves and taller stems than those on higher mountain sites. On the coast of Istria it is said to form considerable bushes with erect branches; while at its highest range it is a dwarf shrub, with woody stems lying on the ground and partly buried in its dark humus. In its time of flower-opening it is singularly constant, the variety of seasons affecting it far less than other plants. I have often noticed this. When we have a hot spring and early summer, and all flowers come before their time, the Heather alone is not hurried out of its normal course. Neither is there as much difference in time as might be expected between the flowering of the plants of lowest and those of highest range. The soil in comparison with the air becomes warmer as the mountain rises, since the earth absorbs the sun's rays much more than the air does, and the air is thinner on the heights than in the valleys; likewise it is the aqueous vapour of the air that absorbs the sun's rays, and since there is less of it the higher one goes, the more heat there is to pour upon the soil. The depredations of the grouse and other young creatures upon the young shoots of the Heather, seem only to thicken its growth; the end of the bitten and mutilated shoot dries up, but the part behind remains alive, and buds on it develop more vigorously than they would have done had the branch remained intact.

Along with the Ling, *Calluna vulgaris*, but in much smaller quantity, not growing in great companies as it does, but in scattered parties here and there, flowering earlier and flowering later, are two Heaths, *Erica cinerea*, called by some Scotch Heather, and *Erica Tetralix*, the cross-leaved Heath. The latter is on the damper moors, the former on the drier hills, but neither of them climbs as high as Ling. Above their range occurs infrequently Cranberry, *Vaccinium Oxycoccos*, in the dampest spots. Bilberry, *V. Myrtillus*, occurs sparsely on moors and in woods and at all elevations. *Vaccinium uliginosum* is rarer, but Cowberry, *V. Vitis-Idæa*, though not so plentiful as Bilberry, runs almost to the summits of the mountains. So we find together along the confines of the grouse moors, seven species of Ericaceæ.

The flowers of Ling, Bilberry, and others of its genus, have bell or cup-shaped corollas, whose drooping stalks turn the mouths of the open flowers to the ground, protecting their pollen and their honey from the wetting rains by which they are so frequently drenched. The Heather flavours two favourite foods—grouse and honey. The Ling is the great honey plant of the north; in many places the hives of the honey-bee are removed bodily to the grouse moor that advantage may be taken by the busy bees of the short September days—their harvest time. The heather honey which they produce is stiff and cannot be removed from its comb, but its flavour is finer and its monetary value greater than the honey of the lowland flowers. The Ericas are almost exclusively fertilized by bees. *Calluna* is partly wind-fertilized and *Juncus* entirely so. So on our grouse moor the bees and the wind divide the office between them, there is no, or almost no intermediate means by flies or smaller insects. The Ling has minute opposite and imbricate linear leaves, the Ericas, Crowberry, and other moorland plants have rolled leaves, which much reduces their surface. The upper side of all rolled leaves is smooth and easily wetted; the under side is the reverse. Here, where stomata are present in great numbers, various devices besides rolling are resorted to, to protect them from water; here are present wax, or fine felt, or rod-shaped projections which look like hairs, but differ from them in being solid, not hollow. In the climatic conditions of the high moors, continuous transpiration from plants is impossible; as there are only short intervals allowed to the leaves for this necessary process, the outlets from the wide-meshed spongy parenchyma are protected from obstruction, and the evergreen rolled leaf, with its enclosed felt, or wax, or rods, seems built up purposely to bar out both rain and mist.

The moor that I know best is crossed by a rough cart track, a good walking place in the fine intervals of a wet season, since there is no traffic and hence no mud. This road is skirted all along the dryer spots by Heath-rush, *Juncus squarrosus*, soon in seed, and many of its capsules used by a moth, *Coleophora juncicolella*, as a standing-place for its white papery cocoons, which simulate bulbils sprouting from the seed vessel; each one contains a grub that is feeding upon the seed; it is the larva of the moth that makes the white paper-like case with an open end, in which to pass the winter; in September the white cocoons are on all the Heath-rushes, even when they are miles apart, and on nothing else. Eyebright flowers, *Euphrasia officinalis*, border this high climbing fell road and large purple heads of *Scabiosa succisa* are numerous among the heather bushes. Here and there on dry banks may still be found the flowers of the pale blue Sheep's-bit, *Jasione montana*. All damp places, where tall rushes do not hide them, are marked out by the creamy white flowers of the beautiful Grass of Parnassus. Yet these autumn flowers are all outdone by the fading bracken of steeper slopes, turning yellow and orange and brown in September days, ever glowing brighter the wetter they are, and visible as the flowers are not for many miles.

There is, perhaps, no plant, apart from forest trees, that affects the scenery of the country which it inhabits as does the common Brake fern, the Bracken, or *Pteris aquilina* of botanical nomenclature. It may be called nature's pigment, wherewith she paints the hill-sides with rich, warm, glowing colour. Yet Bracken is a flowerless plant, a cryptogam, with dull bluish-green leaves, remarkable alone for their size. It is not in life, but in death that these great leaves clothe the hills as with a mantle rich in russet and yellow-brown lines; and it is the dead or winter state that lasts the longest. The Bracken leaves spend the greater part of their lives underground; it is in a single short summer that they culminate, rising rather late in spring, growing up rapidly on stalks five to seven feet high, with much branched blades that are three to four feet across. As they rise rapidly, they rapidly perform their functions, for by September days they are drying up and emptying out the substances they have been producing into thick underground stems. This process leaves them mere strong but empty skeletons, of yellow, orange, ruddy, or pale brown colour; the first night frosts fell them to the earth, and subsequent winter rains seem to bring out more strongly their colour masses.

All the world takes holiday in August, when nature's colouring is at its dullest and most uniform stage. Late October and early May are the most exquisite moments of the year's round, and some weeks on either side of them come next; but, of the two intervening intervals, the winter one is, to my mind, far more beautiful than the summer one. In the northern mountain valleys the gregarious Brake fern is one great feature of winter beauty, as the fallen leaves of the beech trees make another, lying wind-strewn along the bases of mottled mossy walls and leafless hedgerows.

The whole of the stem system of Bracken consists of underground creeping shoots. Ferns, for the most past, have short underground stems bearing a rosette of leaves. Bracken and Polypody, *Polypodium vulgare*, have long horizontal rhizomes, from which leaves are produced at intervals. The leaves alone appear above the ground to develop in the sunlight the products of assimilation, which are then carried back to the earth through the vessels of the leaf-stalk, and deposited as reserve material in the thick subterranean stems.

Among flowering plants a similar mode of life is to be found in Herb Paris and Solomon's Seal. In most plants the primary shoot grows vertically upwards, and the primary root vertically downwards; in Bracken the primary shoot starts from the beginning in a horizontal direction; roots issue from it and penetrate more deeply; buds form on its flanks, each of which gives rise to a single foliage leaf on a vertically erect leaf-stalk. The roots emerge from the stem close behind the growing point, which lies sunk in a funnel-shaped depression of older tissue. The apical cell is the shape of a wedge with two sides, and it becomes segmented into two series of cells, lying in the horizontal stem as a right and left series in straight rows, each series originating its own leaves, and thus producing a succession of leaves in two rows, to the right and the left of the underground shoot. The growing point advances each year only far enough for the production of one new leaf-bud. Adventitious buds may occur on the back of the leaf-stalk near its base. A single superficial cell is the mother-cell of the new shoot, the surrounding tissue growing up round this cell, enclosing it like a wall; the bud may lie dormant for some time, but in this case the leaf-stalk remains succulent, and filled with nutritive substance above the bud long after the leaf has died down. The growth of the new leaf is from its base and its apex; the stalk is first commenced, the blade afterwards at its point; the lowest parts are first formed, then those above them. In old Bracken each leaf occupies two years in its development; the stalk is first formed, and at the end of the first year it is about an inch high, growing from an apical cell, segmenting by oblique walls in alternating directions. In the second summer the leaf-blade begins to grow at the end of the stalk; it is a tiny flat thing, hidden by long hairs, it bends over with its point to the earth, and hangs like an apron from its stem; it grows beneath the ground, and only in the third spring does it emerge into the open air. How quick its growth then is, everyone knows, and how quaint its forms, as, wrapped up in brown hairs, it rises at first a strong, brown, knotted stem, then detaching, raising, and uncurling its much-segmented blade, going through every imaginable attitude of quaint posture. In full maturity these leaves reach great dimensions, a human being may be entirely lost among them; I have heard of Bracken fronds reaching even ten feet high.

NATURE NOTES.

CONTRASTS OF HEAT AND COLD.

The hottest day of a hot month; 80 degrees (we are told) in the shade. A series of dew-drenched mornings, of blazing noons; garden-birds singing,—wren, dunnock, and thrush, while a chaffinch wildly attemps its lost refrain, and the artist-robin incessantly chants a perfect mellifluous song. Honey-bees and gay butterflies, the lesser tortoise-shell by the dozen, and the red admiral, crowding round the mauve-masses of Michaelmas daisies that glisten in dew; hawk-moth

too (*Smerinthus populi*) fluttering to drink of the phlox. Spiders spreading their toils in the sunshine, over every cranny and knob of the house-front, bridging the plants with their lines, decking the hedge-rows with such toils as look like fairy-tents inverted. Mountains, with tops turning pale with their withering grasses, while yet the stretches of woodland beneath are a dull, quiet green. What season do these signs stand for? Not spring, nor summer, nor surely! autumn either, in England. Eighty degrees in the shade! But what here, on the lake? Like a polished mirror lies the water; not a breath of moving air stirs it; not a shadow cools the surface. Then, what peace besides from oars, and keels, and paddles! The noisy tripper has got him to his city home; the tourist-family no longer lurks to fish in every quiet bay; Burdhouse mouth is vacant as when Roman built his camp beside its course. Here is the golden opportunity, literally, of the aquatic botanist. Water absolutely quiet, vivid sun-rays striking down, and the lake bottom to be clearly seen to a considerable depth. Such wondrous life down there! Trailing water-plants, pond-weeds and mil-foil; muddy shells, shoals of fishes, big and little; the grass-like quillwort, pronounced by the botanist to be in splendid form, because, when procured, its leaf-bases are found to hold the ripe egg-like spores that serve it as fruit. But far more lovely than they are the white objects dotted all about its leaves—just like round white berries. They shine thickly where boulder-strewn banks slope steeply to deeper depths, and though when extracted they are a white and delicate bivalve shell (*Cyclas corneum*), they shimmer palely golden in these rich brown quivering depths. All water-lights, indeed, are golden. As the boat pushes to pebbly beach, dancing golden lights of rippled water play not only on the stones, but upon the crimson-fruited guelder-rose trees above the margin, where they are strangely reflected. Golden heat! Sweltering, sickening sunshine! and yet, not a bird deceived! All the summer birds gone; silence and vacancy,—but for an odd jay and gull, in woodland and air. Redstarts, warblers, even swallows long departed. For the swifts were last seen in numbers homing at dusk to the Ambleside houses on August 7th, and the last bird was noted on the 18th; martins swarmed for migration from September 9th onwards to the 15th; on the 18th one got to bed in its nest for the last time about 6.30 p.m.; and none but a few belated stragglers have stayed for this gorgeous pageantry of belated summer days.

* * * * *

Bitter, nipping cold. Frosts of several nights' standing strengthened to 13 degrees last night. The late wild weather left the mountain-ridges sprinkled with snow; this morning the whole visible earth is silver-white under a complete suit of hoar-frost. But at nine a.m. the sun has climbed the bank of mist; it begins to pierce this with powerful, glorious rays, to lick up the rime, and to shine upon the glistening foliage. The blackbird's loud "ting-ting-ting" resounds; the robin bursts into one refrain of gladness (no more can he afford in such a temperature); the blue tit, talking to his mate, flicks about the lime-tree. Bustle and good spirits are in every gesture; for, frost or no frost, his punctual morning beat over the front of the house gives him just now a "beaksome" breakfast; while the spider-hosts that from hot August onwards spread their toils against its stones, and hid their egg-baskets within its crannies, are getting sadly decimated. Here was one *Epeira diadema*, in particular, that supposed itself absolutely secure, so cunningly was its web set in the window-corner beneath the smoothest, most unclaspable-by-claw of slabs. One silken bag of eggs was achieved by September 22nd, and another even by October 10th; and itself, drawn into the smallest compass, lived proudly by them. But lo! where are they and it, this morning? Perhaps the blue tit knows. The silken bags hang torn and frayed; eggs, all but a few entangled ones, gone, and spider too. The egg-less *Epeira* in the opposite corner (this one's mate I fancied) has escaped so far and is alive. In the woods, below the ethereally pale hills, what colours burn now! Red are the beeches in the sunshine; yellow the oaks about the crag. The leaves hold upon them yet; only when the jay alights upon the bough, looking for acorns, does a little shower float about him. The dipper suns his wide white breast serenely on a log by the river; though there are icicles on the road, his water-larder will not fail him; while a great titmouse hammers loud and long within an adjacent bush at some tough morsel he has got. The blackbird ambles along the rowan-tree bough, where of all the ruddy crop, scarce one berry is left. And this October only! Ah! were not the swallows wise, after all?

MARY L. ARMITT.

HEALTH NOTES.

By H. LAING GORDON, M.D.

HEALTH INSPECTION OF SCHOOLS.

It is probable that the more enthusiastic members of the Parents' Union are members also of the British Child-study Association and take a pride in the little publication entitled *The Paidologist* which is issued as the organ of the Association. Some of us, however, may not be familiar with the society or know that Principal Lloyd Morgan is president; he indeed is not one of those psychologists who consider it necessary to conceal ignorance by a cloak of mystical language ornamented with modern scientific phraseology, which nobody can understand and only a few are foolish enough to attempt to understand. Under Professor Morgan great things may be expected. It is to be hoped this Association will show purpose and continuity in its work, and while carrying on the study of children and of childhood will not fail to remember that its work will be judged by the practical results, and that to be of real value there must be progressive purpose, not a mere repetition of first principles *ad nauseam* by different persons in different phraseology in succeeding years.

In the second number of *The Paidologist*, published in July, there is an instructive paper on Health Inspection in Schools, founded upon an article on the same subject which appeared in the *Pedagogical Seminary*. The subject is one which will make many school masters and mistresses shudder; while others will hold their heads high and exclaim, "I fear no inspection"; on the whole the shudderers will be found the easier to deal with, but no schoolmaster or mistress need fear "health inspection" of their scholars if they have the well-being of the children at heart, and very few have not. The subject will be at once acceptable when it is announced that health inspection of schools is carried on in many foreign countries; we find it much easier to imitate than to originate nowadays, sad as it is for Britons to confess it.

"Take for example" says the writer, "the law in Hungary. The school physician is required to investigate the school buildings and surroundings, the floors, windows, doors,